

Appl. No. 10/750,609

Amendt. dated March 1, 2006

Reply to First Office Action of December 1, 2005

Amendment to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

Claim 1 (currently amended): A fuel cell (12) for generating electrical current from first and second reactant streams, comprising:

- a. a membrane electrode assembly (46);
- 5 b. a first reactant flow field (80) secured adjacent a surface selected from the group consisting of a first surface (48) and a second surface (50) of the membrane electrode assembly (46) for directing flow of a first reactant adjacent the selected surface (48, 50) of the assembly (46); ~~and,~~
- 10 c. wherein the first reactant flow field (80) defines a plurality of two-pass circuits (82, 84, 86, 88), each two-pass circuit being in fluid communication with a first reactant inlet (90) for directing the first reactant into the fuel cell (12), and in fluid communication with a first reactant outlet (92) for directing the first reactant out of the fuel cell (12); and,
- 15 d. wherein the reactant flow field (80) defines a common turn-around (96) in fluid communication with each two-pass circuit (82, 84, 86, 88), and the common turn-around (96) being defined between the first reactant inlet (90) and the first reactant outlet (92) so that
- 20

25 the first reactant flowing from the first reactant inlet (90) to the first reactant outlet (92) passes through the common turn-around (96) and mixes within the common turn around (96) with the first reactant passing through the other of the plurality of two-pass circuits (84, 86, 88).

Claim 2 (original) The fuel cell (12) of claim 1, wherein each two-pass circuit (82, 84, 86, 88) defines a width across the two-pass circuit (82), when divided by a cross-flow length (114) of the first reactant flow field, that is
5 greater than 0.1 and less than 0.5, wherein the width across each two-pass circuit (82) is a shortest distance across the two-pass circuit (82) in a direction perpendicular to flow of the first reactant through the two-pass circuit (82), and the cross-flow length (114) of
10 the first reactant flow field (80) is a shortest distance across the first reactant flow field (80) in a direction perpendicular to flow of the first reactant through the flow field (80).

Claim 3 (original) The fuel cell (12) of claim 1, wherein the first reactant flow field (80) is a cathode flow field (20) for directing flow of an oxygen containing oxidant reactant adjacent the selected surface (48) of the membrane
5 electrode assembly.

Claim 4 (original) The fuel cell (12) of claim 1, wherein the first reactant flow field (80) is an anode flow field (28) for directing flow of a hydrogen containing reducing fluid

adjacent the selected surface (50) of the membrane
electrode assembly.

Claim 5 (currently amended) The fuel cell (12) of claim 1,
further comprising a second reactant flow field (28)
secured adjacent the ~~non-selected~~ first or second surface
(48, 50) for directing flow of a second reactant adjacent
the ~~non-selected~~ first or second surface (48, 50), wherein
the second reactant flow field (28) defines a plurality of
two-pass circuits (82, 84, 86, 88), each two-pass circuit
being in fluid communication with a reactant inlet (90) for
directing the second reactant into the fuel cell (12), and
in fluid communication with a reactant outlet (92) for
directing the second reactant out of the fuel cell (12).

Claim 6 (original) The fuel cell (12) of claim 1, wherein the
first reactant flow field (80) is a cathode flow field
(20), the number of two-pass circuits (82, 84, 86, 88) in
each reactant flow field is greater than or equal to 2 and
less than 10, a width across a two-pass circuit (82)
divided by a parallel-flow length of the two-pass circuit
(82) is greater than 0.3 and less than 1.0, wherein the
parallel-flow length of the two-pass circuit (82) is one-
half of a shortest distance along the two-pass circuit (82)
from a point of entry of the reactant stream into the
circuit (82) to a point of exit of the reactant stream from
the circuit (82) in a direction parallel to flow of the
stream through the circuit (82).

Claim 7 (original) A method of managing water within a fuel cell (12) comprising the steps of:

a. securing a first reactant flow field (80) within a fuel cell (12) adjacent a surface of a membrane electrode assembly (46) selected from the group consisting of a first surface (48) and a second surface (50) of the assembly (46); and,

b. directing a first reactant to flow through a plurality of two-pass circuits (82, 84, 86, 88) defined within the first reactant flow field (80); and,

c. directing the first reactant to flow from reactant inlets (90) of the two-pass circuits (82, 84, 86, 88) through a common turn-around (96) defined within the reactant flow field (80), then mixing the first reactants from the reactant inlets (90) within the common turn-around (96), and then directing the first reactant to flow from the common turn-around (96) through reactant outlets (92) of the two-pass circuits (82, 84, 86, 88).

Claim 8 (new) A fuel cell (12) for generating electrical current from first and second reactant streams, comprising:

a. a membrane electrode assembly (46);

b. a first reactant flow field (80) secured adjacent a surface selected from the group consisting of a first surface (48) and a second surface (50) of the membrane electrode assembly (46) for directing flow of a first

reactant adjacent the selected surface (48, 50) of the assembly (46); and,

- 10 c. wherein the first reactant flow field (80) defines a plurality of two-pass circuits (82, 84, 86, 88) defined within porous layers of the flow field (80), each two-pass circuit being in fluid communication with a first reactant inlet (90) for directing the
- 15 first reactant into the fuel cell (12), and in fluid communication with a first reactant outlet (92) for directing the first reactant out of the fuel cell (12).

Claim 9 (new) The fuel cell (12) of claim 8, wherein each two-pass circuit (82, 84, 86, 88) defines a width across the two-pass circuit (82), when divided by a cross-flow length (114) of the first reactant flow field, that is greater

5 than 0.1 and less than 0.5, wherein the width across each two-pass circuit (82) is a shortest distance across the two-pass circuit (82) in a direction perpendicular to flow of the first reactant through the two-pass circuit (82), and the cross-flow length (114) of the first reactant flow

10 field (80) is a shortest distance across the first reactant flow field (80) in a direction perpendicular to flow of the first reactant through the flow field (80).

Claim 10 (new) The fuel cell (12) of claim 8, wherein the first reactant flow field (80) is a cathode flow field (20) for directing flow of an oxygen containing oxidant reactant adjacent the selected surface (48) of the membrane

5 electrode assembly.

Claim 11 (new) The fuel cell (12) of claim 8, wherein the first reactant flow field (80) is an anode flow field (28) for directing flow of a hydrogen containing reducing fluid adjacent the selected surface (50) of the membrane electrode assembly.

Claim 12 (new) The fuel cell (12) of claim 8, further comprising a second reactant flow field (28) secured adjacent the first or second surface (48, 50) for directing flow of a second reactant adjacent the first or second surface (48, 50), wherein the second reactant flow field (28) defines a plurality of two-pass circuits (82, 84, 86, 88), each two-pass circuit being in fluid communication with a reactant inlet (90) for directing the second reactant into the fuel cell (12), and in fluid communication with a reactant outlet (92) for directing the second reactant out of the fuel cell (12)

Claim 13 (new) The fuel cell (12) of claim 8, wherein the first reactant flow field (80) is a cathode flow field (20), the number of two-pass circuits (82, 84, 86, 88) in each reactant flow field is greater than or equal to 2 and less than 10, a width across a two-pass circuit (82) divided by a parallel-flow length of the two-pass circuit (82) is greater than 0.3 and less than 1.0, wherein the parallel-flow length of the two-pass circuit (82) is one-half of a shortest distance along the two-pass circuit (82) from a point of entry of the reactant stream into the circuit (82) to a point of exit of the reactant stream from

the circuit (82) in a direction parallel to flow of the stream through the circuit (82).

Claim 14 (new) The fuel cell (12) of claim 8, wherein the first reactant flow field (80) defines a common turn-around (96) in fluid communication with each two-pass circuit (82, 84, 86, 88), and the common turn-around (96) being defined
5 between the first reactant inlet (90) and the first reactant outlet (92) so that the first reactant flowing from the first reactant inlet (90) to the first reactant outlet (92) passes through the common turn-around (96) and mixes within the common turn around (96) with the first
10 reactant passing through the other of the plurality of two-pass circuits (84, 86, 88).